

CLAIMS

What is claimed is:

1. A valve operating system for an internal combustion engine, comprising:
 - a rocker arm;
 - a rocker actuation mechanism connected to the rocker arm;
 - a ball and socket joint having a retention device connected to a ball portion and a socket portion, where the retention device is positioned in an external groove formed by the socket portion, where the ball portion is connected to the rocker arm; and
 - a valve activation device connected to the socket portion.
2. The valve operating mechanism of Claim 1, where the socket portion has a foot extension, where the socket portion forms a cavity, and where the socket portion forms the exterior groove between the foot extension and an entrance to the cavity.
3. The valve operating mechanism of Claim 1, where the ball portion has a flange between a pin extension and an interface surface.
4. The valve operating mechanism of Claim 1, where the ball portion has a pin extension inserted into a hole formed by the rocker arm.
5. The valve operating mechanism of Claim 1, where the ball portion has an interface surface, where the socket portion forms a cavity with an interior surface, and where the interface surface is positioned adjacent to the interior surface in the cavity.
6. A ball and socket joint for a valve operating system in an internal combustion engine, comprising:
 - a ball portion having a flange between a pin extension and an interface surface;
 - a socket portion having a foot extension, where the socket portion forms a cavity with an interior surface, where the socket portion forms an exterior groove between the foot extension and an entrance to the cavity; and

a retention device having a pin segment connected to a foot segment, where the pin segment forms a pin loop, where the foot segment forms a foot loop;

where the interface surface is positioned adjacent to the interior surface in the cavity,

where the pin extension is disposed in the pin loop,

where the pin segment is adjacent to the flange,

where the socket portion is disposed in the foot loop, and

where the foot segment is positioned in the external groove.

7. The ball and socket joint of Claim 6, where the interface surface has a smaller cross-section than the flange.

8. The ball and socket joint of Claim 6, where the pin extension has a smaller cross-section than the flange.

9. The ball and socket joint of Claim 6, where the pin loop has a smaller cross-section than the flange.

10. The ball and socket joint of Claim 6, where the socket portion has a smaller cross-section at the exterior groove than at the foot extension.

11. The ball and socket joint of Claim 6, where the socket portion has a smaller cross-section at the exterior groove than at the entrance to the cavity.

12. The ball and socket joint of Claim 11, where the socket portion has a smaller cross-section at the exterior groove than at foot extension.

13. The ball and socket joint of Claim 6, where the foot segment extends partially along a circumference of the exterior groove.

14. The ball and socket joint of Claim 6, where the pin segment extends partially along a circumference of the pin extension.

15. The ball and socket joint of Claim 6, where the pin segment forms a plurality of windings around the pin extension.

16. An internal combustion engine with a valve operating system, comprising:
a cylinder head mounted on a crankcase, where the cylinder head and crankcase form a cylinder, where the cylinder head forms a valve path connected to the cylinder;
a valve disposed within the valve path;
a rocker arm mounted on the cylinder head;
a rocker actuation mechanism connected to the rocker arm;
a ball and socket joint having a retention device connected to a ball portion and a socket portion, where the retention device is positioned in an external groove formed by the socket portion, where the ball portion is connected to the rocker arm; and
a valve activation device connected to the socket portion, where the valve activation device is connected to the valve.

17. The internal combustion engine of Claim 16, where the socket portion has a foot extension, where the socket portion forms a cavity, and where the socket portion forms the exterior groove between the foot extension and an entrance to the cavity.

18. The internal combustion engine of Claim 16, where the ball portion has a flange between a pin extension and an interface surface, where the socket portion forms a cavity with an interior surface, and where the interface surface is positioned adjacent to the interior surface in the cavity.

19. The internal combustion engine of Claim 18, where the pin extension is inserted into a hole formed by the rocker arm.

20. The internal combustion engine of Claim 16, where the valve is one of an inlet valve and an exhaust valve.